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Eric Krotkov, Ph.D.
Program Manager
DARPA, Tactical Technology Office
(703) 696-4644
ekrotkov@darpa.mil

TACTICAL MOBILE ROBOTICS



Vision

Enable land forces to dominate battlespace
using teams of mobile robots
in complex terrain (e.g., urban, indoor, rugged)

Enabling Technologies

Perception Autonomy Locomotion

Preliminary System Design



System Demonstration

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Overall vision for the Tactical Mobile Robotics program. Graphic shows that the individual technologies and preliminary system design will be combined in a comprehensive system demonstration.

PANTHER



Length: 11 m
Mass: 44,000 kg

Developed under the Joint Robotics Program, the Panther—a VTC-M60 variant—is an example of one type of military robot currently available. The Panther is a teleoperated robotic vehicle weighing more than ten tons. Its physical dimensions clearly distinguish it from the goals of the Tactical Mobile Robotics program, which is to develop much smaller (meter size), light weight (man portable), semi-autonomous robots.

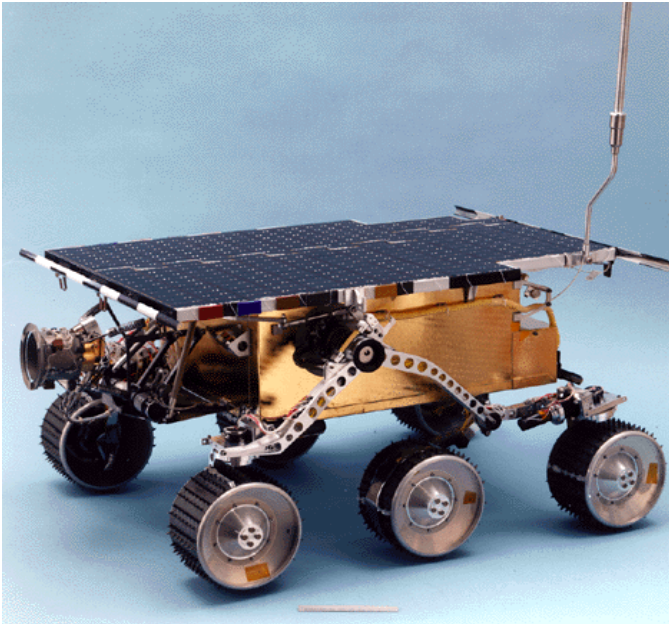
DEMO II



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Although much smaller than the Panther, the Demo II Surrogate Semiautonomous Vehicle (SSV)—a modified Humvee—far exceeds the size and weight goal of Tactical Mobile Robotics.

SOJOURNER



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Length: 65 cm
Mass: 10 kg
Speed: 1-10 cm/sec

A familiar robot from the NASA Mars Pathfinder mission, Sojourner, developed by Jet Propulsion Laboratory, has introduced many to the capabilities of smaller robots. Sojourner's slow and restrictive locomotion and reliance on supervised operation, however, still distinguish it from what is being attempted with Tactical Mobile Robotics.

PROCUREMENT STRATEGY



- Government team to derive mission requirements
- Single two-part BAA for FY98, FY99
 - Part A: 3 - 5 performers for technology dev't.
 - Part B: 2 - 3 performers for system design
- Exercise selected options for FY00, FY01
 - 1 performer team for system demonstration

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Procurement strategy for Tactical Mobile Robotics.

MISSION ANALYSIS AND REQUIREMENTS

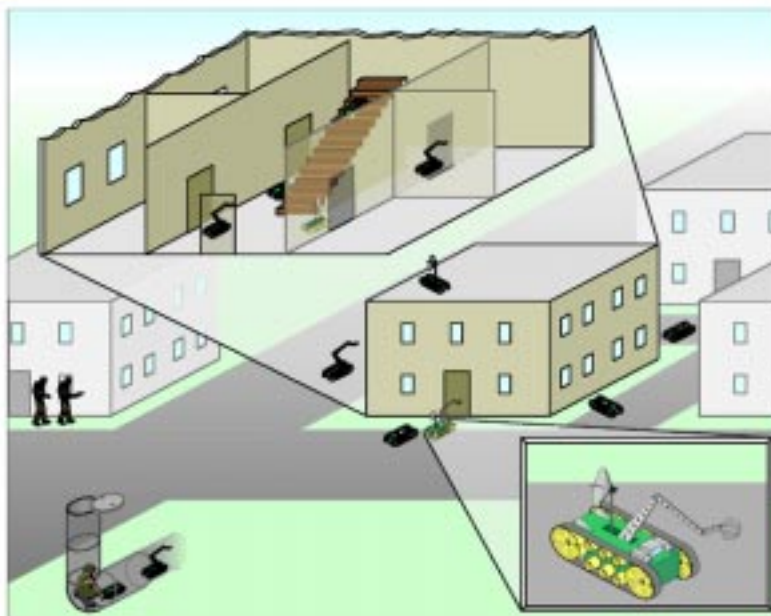


- Government Team
 - DARPA (Chair), USA, USMC, SOCOM, Intel
 - Analyze mission needs for robots, derive requirements
- Application Areas of Interest
 - To Date: urban assault, covert reconnaissance, building recon
 - Future: mobile sensor, urban assault from air, logistics, ...

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Government team will analyze mission needs and requirements, and recommend potential applications for demonstration.

SYSTEM CONCEPT FOR URBAN BUILDING SEARCH



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Graphic depicts possible urban assault scenario for system demonstration.

Technology Topics (goals stated later in briefing)

- Perception
- Autonomous Navigation
- Locomotion

Allow each performer to develop and mature relevant technologies for up to 18 months

- Breadboards
- Critical Technology Demonstrations
- Brassboards

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Primary technology interests for Tactical Mobile Robotics are perception, autonomous navigation, and locomotion.

NOTIONAL PERCEPTION GOALS



Measurement

Approximate Goal

Hazard
Detection

Multi-sensor, 20 Hz
> 80% dm-scale hazards
> 95% m-scale hazards

Object
Velocity

Machine vision, audition
10% accuracy at 30 Hz

Indoor Position
Estimation

Aided inertial navigation
10 m accuracy over 24 hrs.

Multi-Source
Mapping

Machine vision
Topological map w/ 90% accuracy

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Notional robot perception goals.

NOTIONAL AUTONOMY GOALS



Technology

Approximate Goal

Autonomous
Terrain Traversal

Travel 10-100 m per command

Multi-Robot
Collaboration

10X fewer commands per task

Multi-Robot
Reconfiguration

10X more likely to complete
tactical op'n in unit time

Autonomous
Mission Execution

1 command per sortie for
special-purpose mission

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Notional robot autonomous navigation goals.

NOTIONAL LOCOMOTION GOALS



Travel

Approximate Goal

Ground

> 100 cm/s, 10 cm rubble
> 25 cm step, 20 kg

Parasitic

Platform 1-50 cm
Attach to host < 30 km/hr

Climbing

Platform 1-50 cm
Climb 10 m wall

Digging

Burrow 50 cm through soil
Quiet, power-efficient

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Air-Dropped

Land & self-right after 100 m drop

Notional locomotion goals for Tactical Mobile Robotics.

Preliminary System Design

- Translate mission requirements to system performance requirements
- Develop set of system definitions which can be implemented in a system concept which would demonstrate the system requirements
- Prioritize system definition set
 - User needs/user commitment
 - Unique/high risk technologies demonstrated
 - Performance/schedule/cost risk assessment

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Plan for system design.

System Integration and Demonstration

- Define and execute System Breadboard/Brassboard which demonstrates system performance requirements
- Define and execute System Demonstration which demonstrates system operational requirements (e.g., form, fit, function)
- Integrate technology brassboards into systems

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Plan for system demonstration.

CONTRACT OPPORTUNITIES



Preliminary funding estimates for FY98-01

Anticipated Contracts

- 1997 Technology Development (~\$18M)
- 1997 Preliminary System Design (~\$5M)
- 1999 System Demonstration (~\$19M)

Previously Awarded Contracts

- 1997 Urban Robotics (BAA 97-20) (~\$4M)

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Contract opportunities for Tactical Mobile Robotics.

Tactical Mobile Robotics, a new FY98 program

As a consequence

- Technology goals are representative,
not definitive
- Schedule and budget figures are tentative

Important caveats to consider.